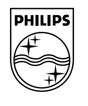
# DATA SHEET

# TDA7088T
## FM receiver circuit for battery supply

Product specification
Supersedes data of January 1991
File under Integrated Circuits, IC01

1996 May 14

**Philips Semiconductors**






## FEATURES

- Equipped with all stages of a mono receiver from antenna to audio output
- Mute circuit
- Search tuning with a single varicap diode
- Mechanical tuning with integrating AFC
- AM application supported
- Power supply polarity protection
- Power supply voltage down to 1.8 V.

## APPLICATIONS

- Mechanical tuning; this is possible with or without integrating AFC circuit
- Electrical tuning; this is realized by one directional (band-up) search tuning facility, including RESET to the lower-band limit.

## GENERAL DESCRIPTION

The TDA7088T is a bipolar integrated circuit for use in mono portable and pocket radios. It is used when a minimum of peripheral components (of small dimensions and low costs) is important. The circuit contains a frequency-locked-loop (FLL) system with an Intermediate Frequency (IF) of about 70 kHz. Selectivity is achieved by active RC-filters. De-tuning related to the IF and too weak input signals is suppressed by the mute circuit.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_P$ | supply voltage | | 1.8 | 3 | 5 | V |
| $I_P$ | supply current | | 4.2 | 5.2 | 6.6 | mA |
| $f_{iRF}$ | radio input frequency | | 0.5 | – | 110 | MHz |
| $V_{i(rms)}$ | RF sensitivity input voltage (RMS value) | $V_{oAF}$ = –3 dB; $V_{oAF}$ = 0 dB at $V_i$ = 1 mV; mute off | – | 3 | 6 | μV |
| | signal handling | Δf = ±75 kHz; THD < 10% | 100 | 200 | – | mV |
| $V_{o(rms)}$ | audio output signal (RMS value) | $R_L$ = 22 kΩ | 60 | 85 | 120 | mV |
| $T_{amb}$ | operating ambient temperature | | –10 | – | +70 | °C |

## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE | | |
|---|---|---|---|
| | NAME | DESCRIPTION | VERSION |
| TDA7088T | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |

# FM receiver circuit for battery supply TDA7088T

## BLOCK DIAGRAM AND APPLICATION CIRCUIT

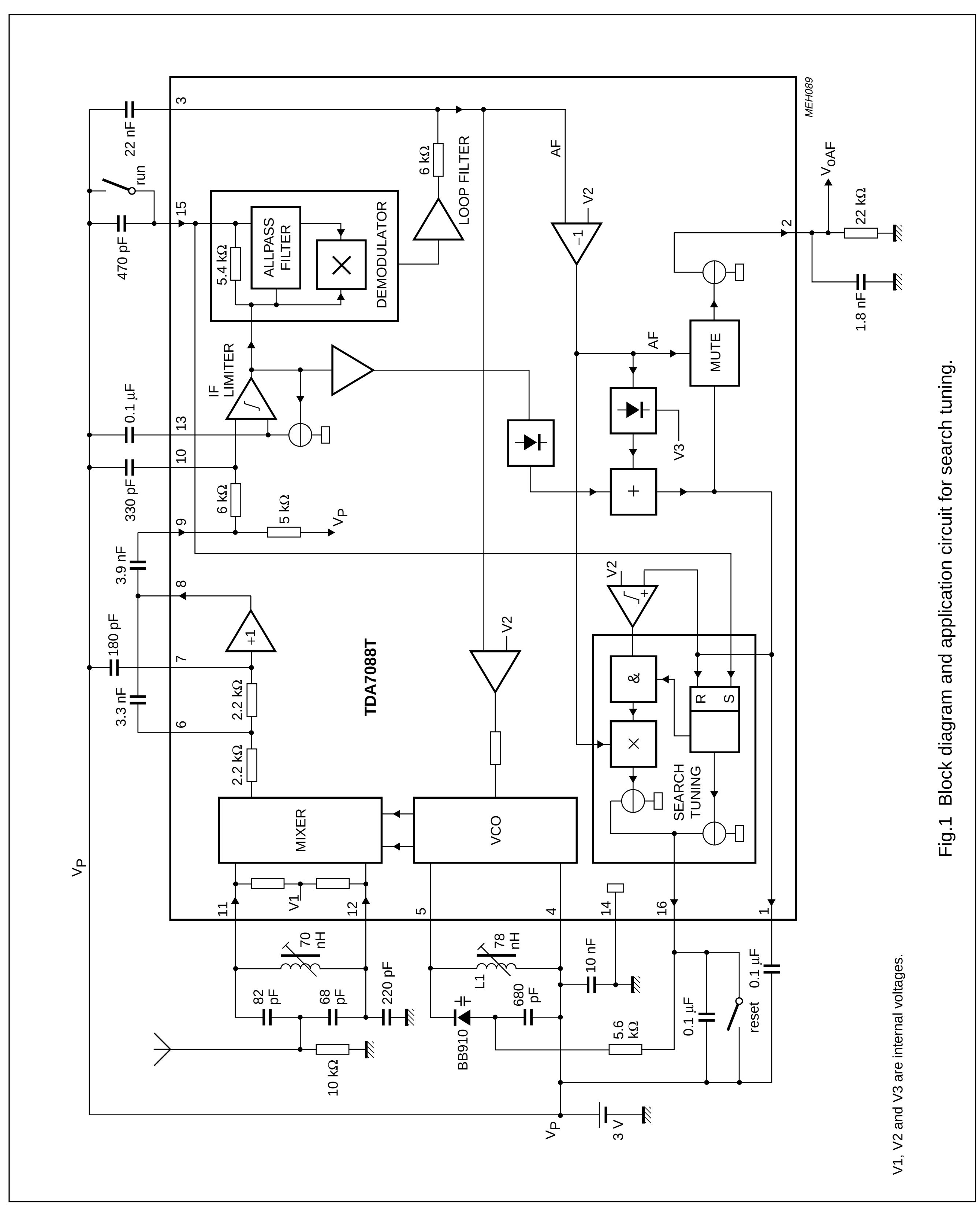



Fig.1 Block diagram and application circuit for search tuning.

V1, V2 and V3 are internal voltages.

## PINNING

| SYMBOL | PIN | DESCRIPTION |
|---|---|---|
| MUTE | 1 | mute output |
| $V_{oAF}$ | 2 | audio frequency output signal |
| LOOP | 3 | AF loop filter |
| $V_P$ | 4 | +3 V supply voltage |
| OSC | 5 | oscillator resonant circuit |
| IFFB | 6 | IF feedback |
| $C_{LP1}$ | 7 | low-pass capacitor of 1 dB amplifier |
| $V_{oIF}$ | 8 | IF output to external coupling capacitor (high-pass) |
| $V_{iIF}$ | 9 | IF input to limiter amplifier |
| $C_{LP2}$ | 10 | low-pass capacitor of IF limiter amplifier |
| $V_{iRF}$ | 11 | radio frequency input |
| $V_{iRF}$ | 12 | radio frequency input |
| $C_{LIM}$ | 13 | limiter offset voltage capacitor |
| GND | 14 | ground (0 V) |
| $C_{AP}$ | 15 | all-pass filter capacitor/input for search tuning |
| TUNE | 16 | electrical tuning/AFC output |

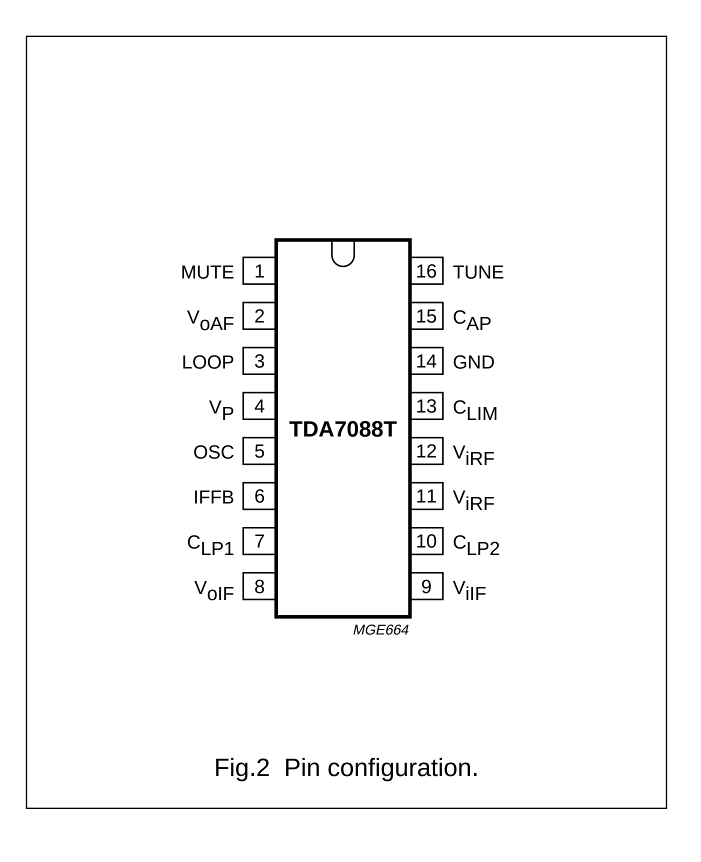



Fig.2 Pin configuration.

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | MIN. | MAX. | UNIT |
|---|---|---|---|---|
| $V_P$ | supply voltage | 0 | 5 | V |
| $T_{stg}$ | storage temperature | –55 | +150 | °C |
| $T_{amb}$ | operating ambient temperature | –10 | +70 | °C |
| $V_{es}$ | electrostatic handling; note 1 | – | – | – |

**Note**

1. There is no special ESD protection circuit built-in; ESD data on request.

## DC CHARACTERISTICS

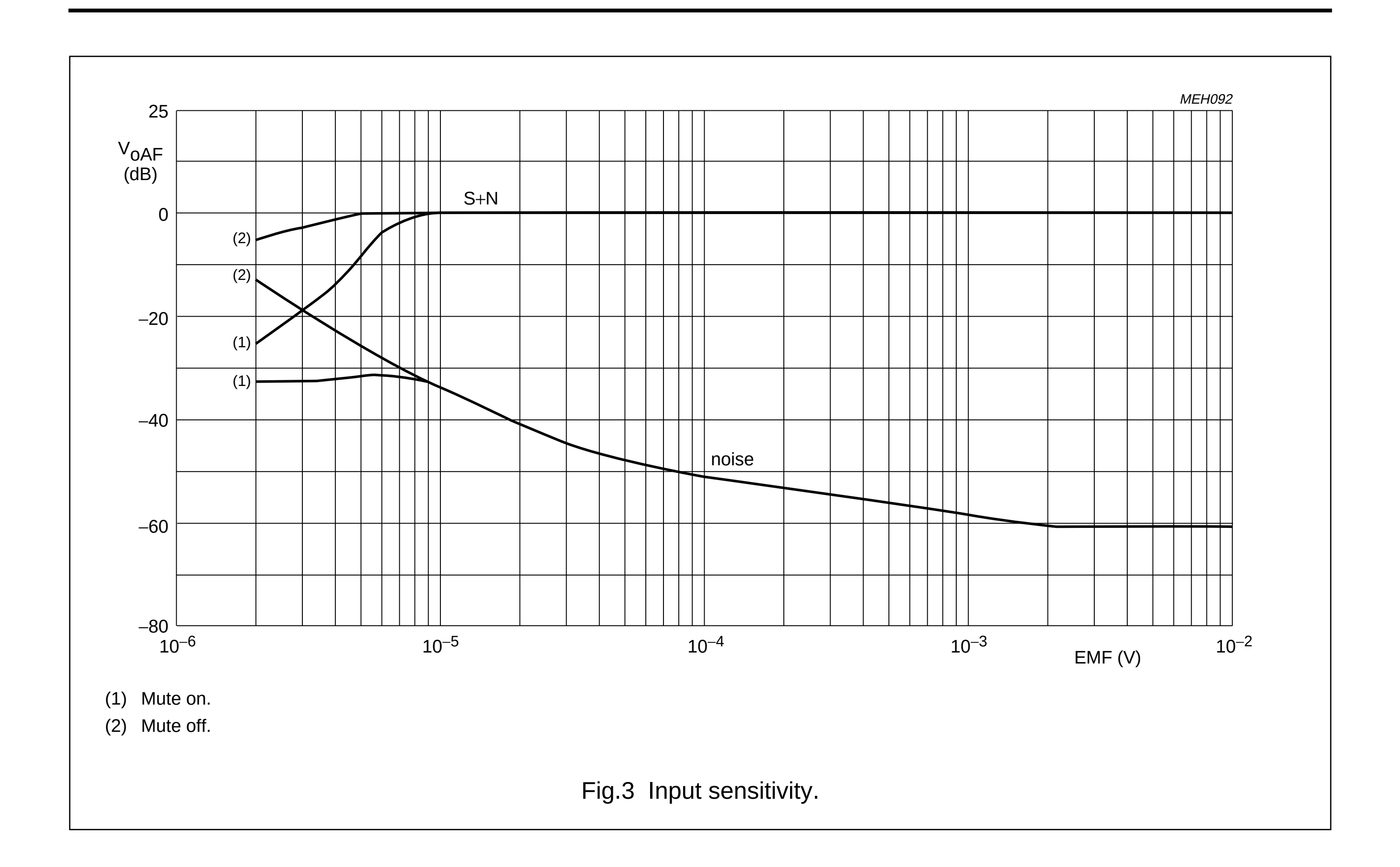
$V_P$ = 3 V; $T_{amb}$ = 25 °C; unless otherwise specified.

| SYMBOL | PARAMETER | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_P$ | supply voltage (pin 4) | 1.8 | 3 | 5 | V |
| $I_P$ | supply current (pin 4) | 4.2 | 5.2 | 6.6 | mA |
| $V_1$ | DC voltage on pin 1 | 2.50 | 2.55 | 2.60 | V |
| $V_3$ | DC voltage on pin 3 | 2.64 | 2.69 | 2.74 | V |
| $V_{6, 7}$ | DC voltage on pins 6 and 7 | 2.38 | 2.44 | 2.50 | V |
| $V_8$ | DC voltage on pin 8 | 1.60 | 1.67 | 1.74 | V |
| $V_{9, 10, 13}$ | DC voltage on pins 9, 10 and 13 | 2.42 | 2.47 | 2.52 | V |
| $V_{11, 12}$ | DC voltage on pins 11 and 12 | 0.91 | 0.94 | 0.98 | V |
| $V_{15}$ | DC voltage on pin 15 | 2.06 | 2.12 | 2.18 | V |
| $I_2$ | AF output current on pin 2 | 45 | 60 | 80 | μA |
| $I_5$ | oscillator current on pin 5 | 275 | 375 | 500 | μA |

## AC CHARACTERISTICS

$V_P$ = 3 V; $T_{amb}$ = 25 °C; $f_{iRF}$ = 96 MHz modulated with $f_{mod}$ = 1 kHz and ±22.5 kHz deviation; $V_i$ = 400 μV (measured as EMF; $R_S$ = 75 Ω) and measurements taken in Fig.4; unless otherwise specified.

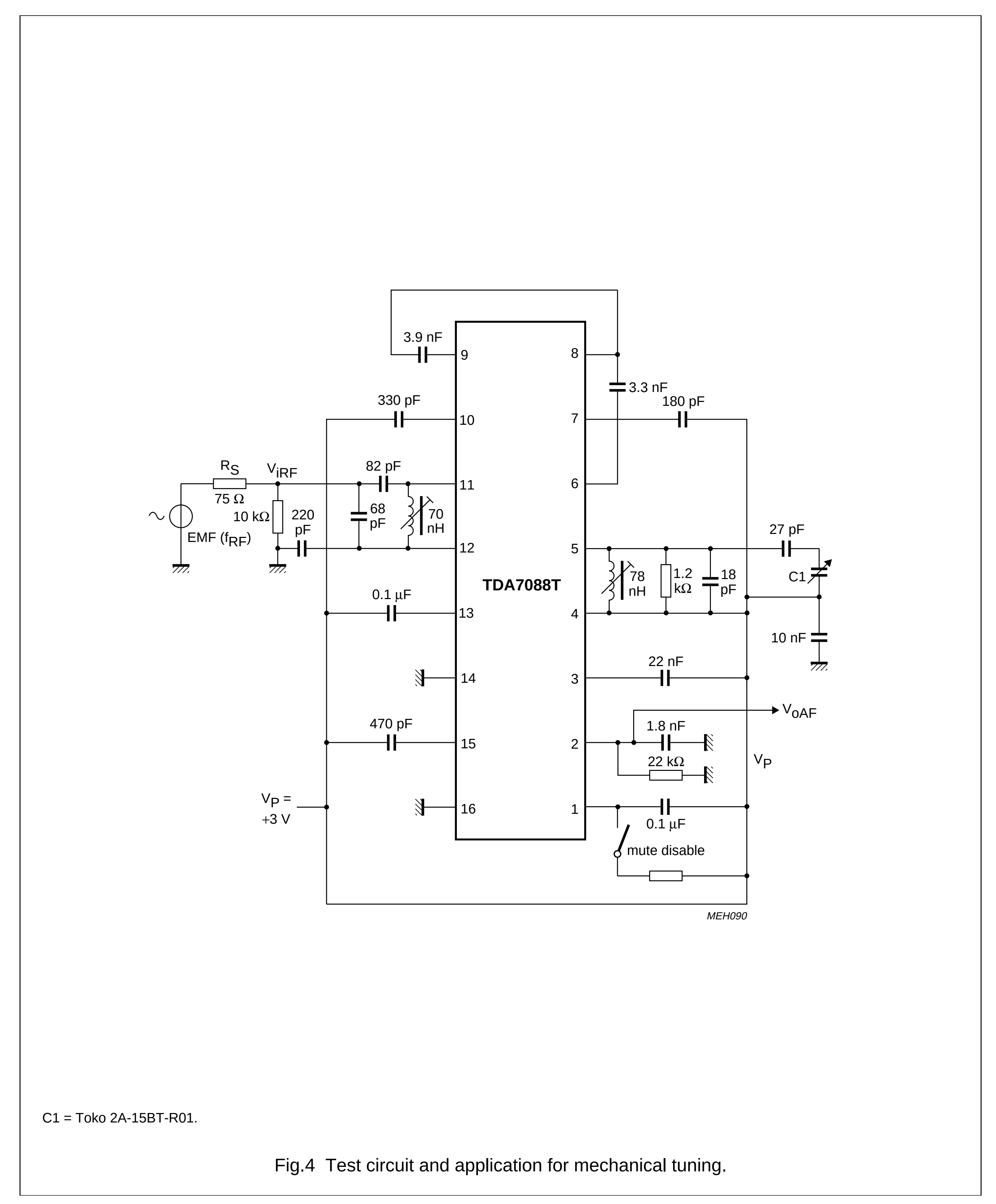
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{i(rms)}$ | RF sensitivity input voltage (RMS value) | $V_{oAF}$ = –3 dB; $V_{oAF}$ = 0 dB at $V_i$ = 1 mV; see Fig.3 | | | | |
| | | mute off | – | 3 | 6 | μV |
| | | mute on | 3 | 6 | 12 | μV |
| | | $\frac{S+N}{N}$ = 26 dB | – | 5 | 10 | μV |
| | signal handling | Δf = ±75 kHz; THD < 10% | 100 | 200 | – | mV |
| $\frac{S+N}{N}$ | signal plus noise-to-noise ratio | see Fig.3 | 52 | 56 | – | dB |
| THD | total harmonic distortion | Δf = ±22.5 kHz | – | 1 | 1.4 | % |
| | | Δf = ±75 kHz | – | 2.4 | 3.3 | % |
| $\alpha_{AM}$ | AM suppression | FM: 1 kHz; ±75 kHz; AM: 1 kHz; m = 0.8 | 47 | 52 | – | dB |
| $RR_{1000}$ | ripple rejection | 100 mV RMS ripple on $V_P$; f = 1 kHz | 7 | 10 | – | dB |
| $V_{o(rms)}$ | audio output signal (RMS value) | $R_L$ = 22 kΩ | 60 | 85 | 120 | mV |
| **Search tuning** (with BB910 and $C_{16}$ = 0.1 μF) see Fig.1 | | | | | | |
| $V_{16}$ | minimum output voltage on pin 16 | limiting point | – | $V_P$ – 1.85 | – | V |
| ΔV/Δt | tuning steepness | voltage at pin 16 | 95 | 210 | 420 | mV/s |
| $\Delta f_{osc}/\Delta t$ | oscillator steepness | | 1.25 | 2.83 | 5.6 | MHz/s |
| $\Delta I_{AFC}/\Delta V_3$ | AFC steepness | voltage at pin 3 | 4.75 | 9.5 | 19 | μS |




(1) Mute on.
(2) Mute off.

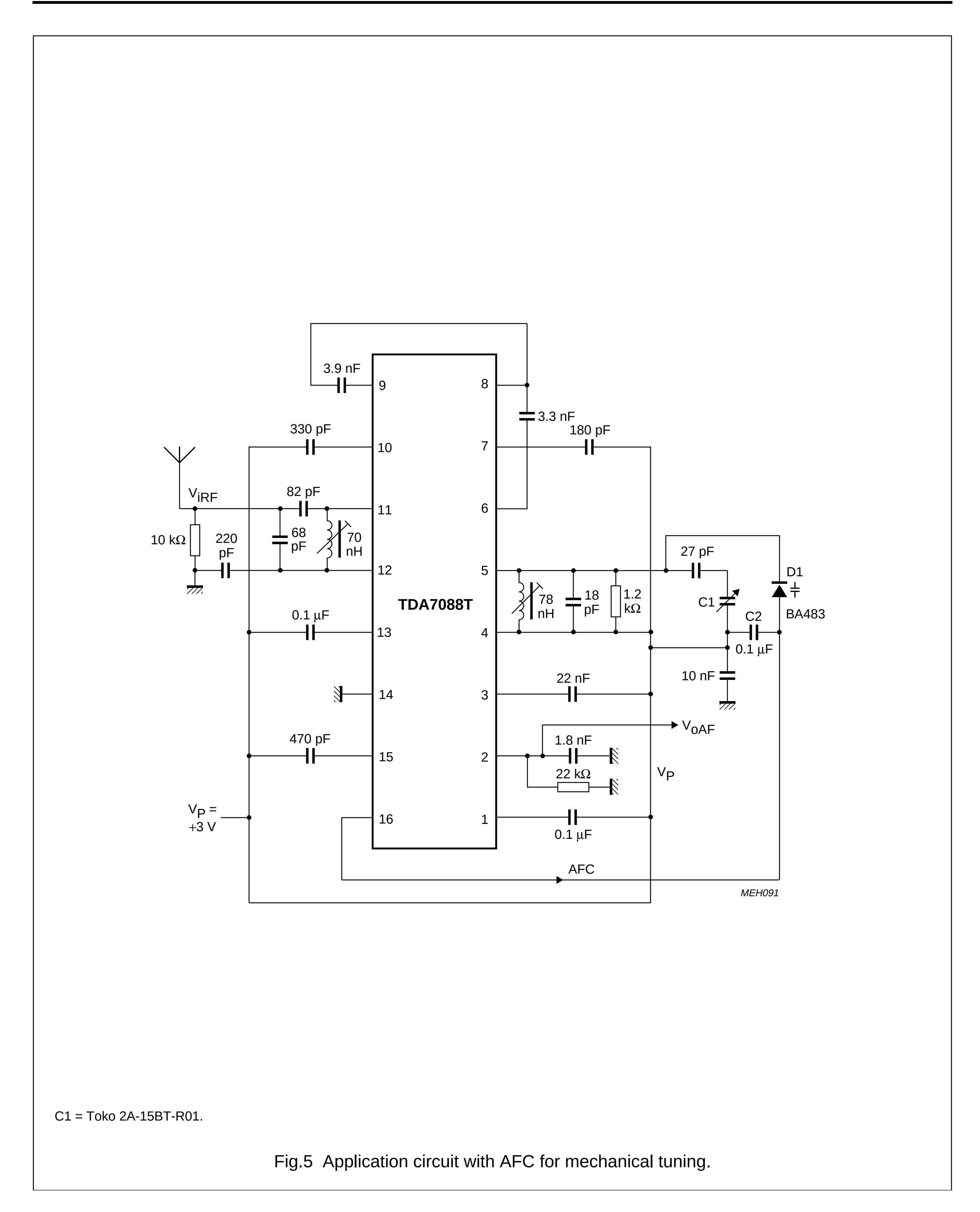
Fig.3 Input sensitivity.

## TEST AND APPLICATION INFORMATION



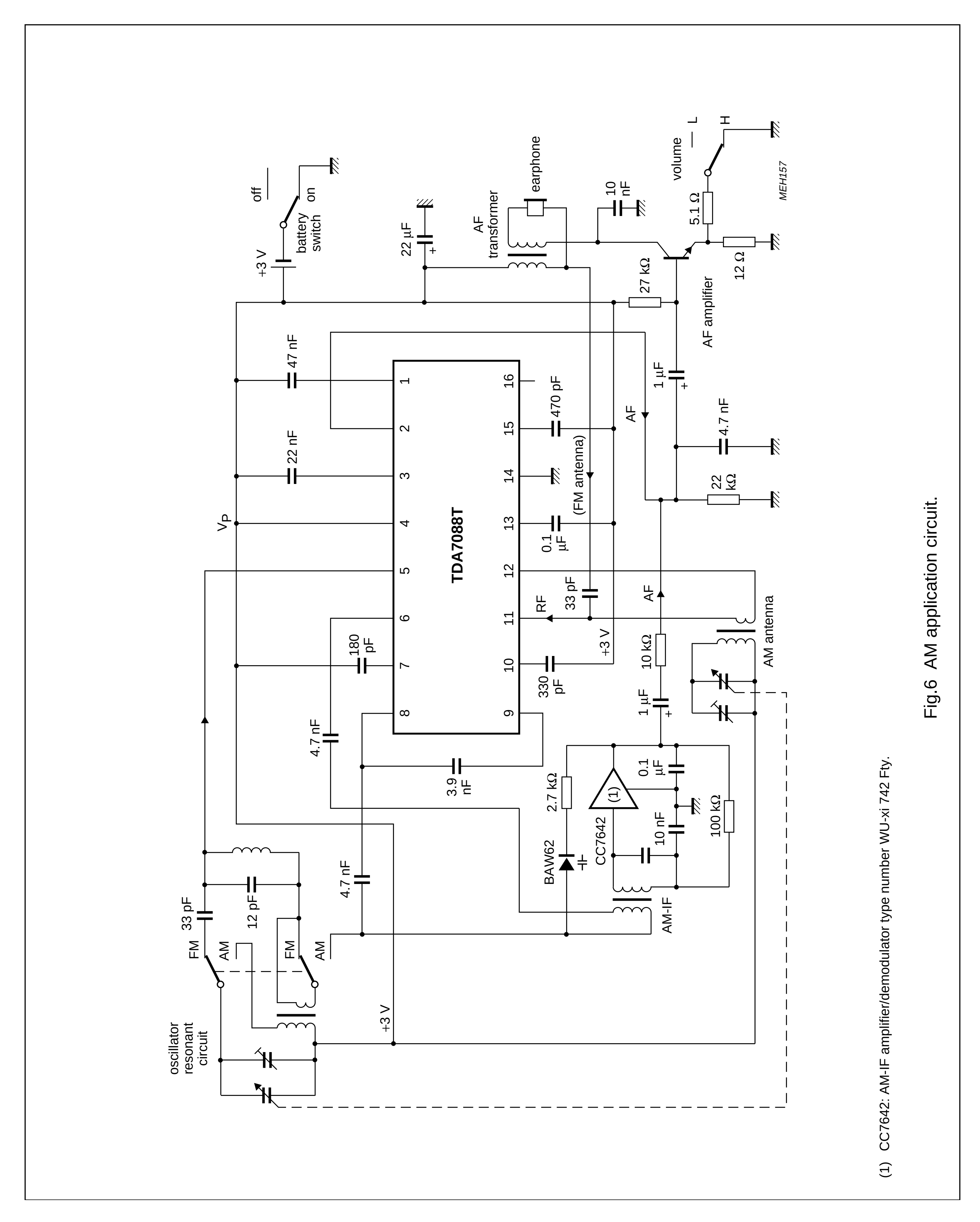

C1 = Toko 2A-15BT-R01.

Fig.4 Test circuit and application for mechanical tuning.




C1 = Toko 2A-15BT-R01.

Fig.5 Application circuit with AFC for mechanical tuning.

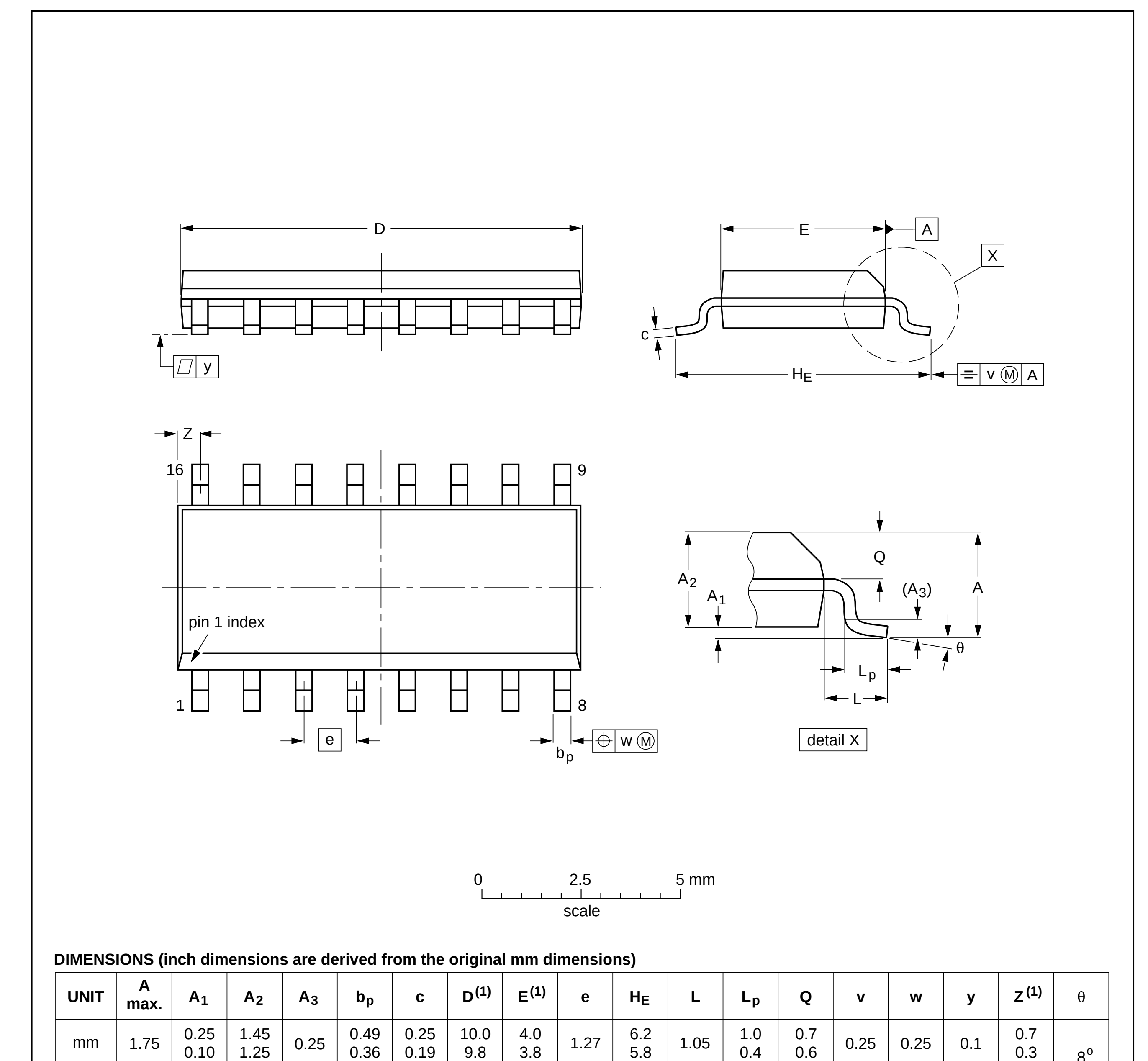



(1) CC7642: AM-IF amplifier/demodulator type number WU-xi 742 Fty.

Fig.6 AM application circuit.

## PACKAGE OUTLINE

**SO16: plastic small outline package; 16 leads; body width 3.9 mm** **SOT109-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (1) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 10.0<br>9.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.0098<br>0.0039 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0098<br>0.0075 | 0.39<br>0.38 | 0.16<br>0.15 | 0.050 | 0.24<br>0.23 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT109-1 | 076E07S | MS-012AC | | | | ~~91-08-13~~<br>95-01-23 |

## SOLDERING

### Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

### Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

### Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

### Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

## DEFINITIONS

| **Data sheet status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
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**NOTES**

## NOTES

**NOTES**

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Printed in The Netherlands

517021/1200/02/pp16 Date of release: 1996 May 14
Document order number: 9397 750 00843

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